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Peripartum and early post partum in the cow – physiology and pathology

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Introduction

The peri- and early post- partum period in the dairy cow is from a reproductive perspective very important. The calving process itself involves cases that may need veterinary intervention e.g. dystocia and stillbirths. Uterine prolapse, retained foetal membranes and metritis are examples of disturbances which occur early post partum. All these dysfunctions are linked together and may interfere with future production, fertility and health and thereby affecting the economics for the herd³. The task for the practitioner is to give the most efficient treatments that will satisfy the animal as well as the farmer and the society but also to give proper advice for prevention. In this presentation the most common reproductive disturbances in the peri- and early post-partum period will be briefly reviewed.

The Peripartum physiology

During late pregnancy several hormones are involved to maintain and to deliver a live calf at parturition. Progesterone, high levels during the whole pregnancy period, originating from the corpus luteum, maternal adrenals and placenta and oestrone sulphate produced by the placentomes, elevated levels from about mid-pregnancy until the expulsion of the foetal membranes, are two examples. For the normal parturition, a change from progesterone to oestrone synthesis is crucial. The increasing levels of oestrone are time-related to an increased synthesis of prostaglandin F_{2α} causing prepartal luteolysis and several hormones are then involved in the labour process such as prostaglandin F_{2α}, cortisol and oxytocin. Levels of pregnancy associated glycoproteins (PAGs), originating from the trophoblastic binucleate cells increase during the last 10 days prior to parturition.

Spontaneous parturition involves a series of physiological events such as cervical ripening and dilatation, activation of the uterine musculature, the attainment of the right presentation and posture by the foetus, expulsion of the foetus and the detachment and expulsion of the placenta. Each of these events includes complicated biochemical changes and changed sensitivities to different stimulating agents (eg. relaxin, oxytocin) of the different tissues involved⁹.

Ideally, the postpartum period is a non-infectious event. A reduction in uterine size and a unidirectional flow of uterine contents as well as gradual closure of the cervix prevents microbial contamination. However, the reality is that the uterus invades by microorganisms to a variable extent depending on the animal's susceptibility and the hygienic condition of the

environment. In cases of retained foetal membranes the uterus will always be invaded by bacteria. The uterine involution is a physiological process by which the uterus shall be prepared to harbour a new pregnancy. The time for involution varies between 20-50 days and involves three steps; expulsion and shrinkage, necrosis and sloughing of the caruncles and regeneration of the endometrium. Both facultative anaerobic bacteria and obligate anaerobic bacteria are frequently found in the uterus. In general the highest numbers of bacteria are found the second week p.p. and thereafter the proportion of positive samples decline and most animals are bacteriological negative within 5 weeks post partum without any treatment. Involution of the uterus and the eradication of bacteria are closely associated with plasma prostaglandin (PG) levels. $\text{PGF}_{2\alpha}$ is produced in large amounts by the uterus during early postpartum. A higher magnitude and a longer duration of the PG metabolite concentrations in plasma have been associated with rapid involution⁷. In the uncomplicated postpartum cow there is a rapid decrease in PG-metabolites during the first week pp and the concentrations return to basal level by the end of the 2nd week pp. In cows with retained foetal membranes however, the PG levels do not decline to basal levels but are elevated as long as bacteria are present in the uterus. When the PG metabolite levels are close to baseline the first ovulation can occur which means that uterine infections also influence the time of the first ovulation.

Dystocia and stillbirths

The normal situation is that the cow shall be able to deliver the calf without intervention by anybody. However in some cases calving aid is a must to rescue the calf. Familiar cases for the practitioner are dystocia due to postural defects or oversized calves. During the last decades there has been a trend of increasing rates of stillbirths especially in Holstein Friesian (HF) heifers. This has sometimes been interpreted as the result of an increased dystocia rate. Recently a more comprehensive analysis of the problem has been undertaken e.g. in Scandinavia. During the last 20 years the stillbirth rates in the Swedish HF-heifer population has increased from 4% to 11% while calving difficulties has only increased from 6 to 7,5 %. The large variation in stillbirth rates between daughter groups of bulls (2-27 %) points at genetic defects and sublethal genes as one factor. Also infections (e.g. *BVDV* and *Neospora caninum*) and management factors e.g. improper feeding and decreased time for calving supervision are possible causes. In a recent experiment we monitored HF-heifers sired by bulls with high stillbirth rates from 7 months of pregnancy to calving⁴. In this strictly selected risk group ¼ of the heifers gave birth to dead calves of which the majority of the calves were recorded alive shortly before calving but were delivered dead without any calving difficulties. In these heifers we found decreased levels of both PAGs and oestrone sulphate indicating placenta dysfunctions as possible physiological cause behind stillbirths. The increasing stillbirth rates focuses on the need of a recording system for calving performance, which also exists in many countries e.g. Scandinavia and the consideration of the stillbirth trait in breeding programmes. Farmers should be recommended not to use AI-bulls with poor breeding values for stillbirths to HF-heifers.

Uterine Prolapse

Uterine prolapse is the protrusion of the uterus from the vulva with the mucosal surface exposed. Several factors predispose for uterine prolapse e.g. atoni of the uterus due to hypocalcaemia, open cervix (prolapse seldom occurs later than one day after parturition), slack pelvic ligaments and abdominal straining (e.g. caused by partially detached foetal membranes

or by vaginal prolapse). In a recently performed retrospective study in UK by Murphy and Dobson⁸ containing 90 cases of uterine prolapse there was a predisposition in younger beef animals and in older cows. The mortality rate was 20% and shock was a common cause of death. Assisted calving in heifers and hypocalcaemia in older cows were predisposing factors for uterine prolapse. There is a general agreement in the literature that the risk of repetition of the condition at subsequent calvings is small. The prognosis for future fertility will depend of factors as bacterial contamination and the degree of trauma of the uterus. In the material from UK, referred to above⁸, consisting of 40 cows recovered from uterine prolapse and presented for insemination 25 % were later culled due to infertility compared to 5.5% in a control group. The treatment aims to push back the uterus as soon as possible and there are some tips and tricks which makes this process easier¹⁰. The first advice to the farmer is to prevent the situation becoming more serious by protecting the uterus from further damage and contamination. Attention should be paid to signs of shock, haemorrhage, ruminal tympani and hypocalcaemia. Hypocalcaemic animal should be treated before reposition and epidural anaesthesia may reduce abdominal straining. If the cow is not able to stand the animal must be positioned in sternal recumbency with the hind parts positioned as high as possible. The replacement should start with the part closest to the vulva. Special care must be taken to prevent caruncles from being torn off. After reposition the inversion of the uterine horns is corrected as deep as possible. Aftercare aims to stimulate uterine contraction and to prevent abdominal straining. Antibiotics should be administered systemically.

Retained Foetal Membranes

The physiological process of placental detachment is initiated several weeks before parturition, but is not completed until the time for expulsion of the foetus. A maturation process leads to a successive weakening of the borderline between the cotyledonary and caruncular parts of the placentome. The process includes connective tissue remodelling and chemotactic attraction of leucocytes. Retained foetal membranes (RFM) is defined as placentas not detached after 12 hours postpartum. There are several risk factors for RFM e.g. short or long gestation, abortion, stillbirth, dystocia, twinning, induction of parturition, non hygienic calving conditions and fat cows. Patho-physiological causes are e.g. immature placentomes, oedema of the chorionic villi, placentitis and uterine atony. Recently it has been suggested that improper foetal-maternal signalling linked to defects of the immunological system may be a cause to RFM. The natural recovery rate is high in uncomplicated cases. As a result of necrosis taking place in the caruncles, most retained placentas are expelled by 5-11 days p.p. The traditional treatment is manual removal of the placenta. The advantage is the improvement of the hygienic condition in the stable. However, manual removing can damage the uterine wall and suppress the uterine natural immunological defence. Most of the literature available confirms no improvement by manual removing of RFM compared to untreated controls. Our own studies² also support this view since a conservative approach did not prolong the PGF_{2α} release or delayed the resumption of ovarian activity. Arthur et al.¹ recommend no treatment in uncomplicated cases but state: "It requires courage to prescribe no treatment, and it would be imprudent to adopt a rigid attitude of non interference". However a conservative approach needs a close supervision of the cow's temperature and appetite. Any signs of systemic illness should immediately lead to treatment by parental administration of antibiotics. RFM cows are regarded as "risk-cows" for chronic endometritis and pyometra and should therefore be re-examined after 4 weeks.

Metritis and Endometritis

Postpartum metritis results from uterine contamination with bacteria during parturition. Several studies have shown that the bacterial endometritis that follows e.g. non-treated RFM cases has a strong tendency to self-cure. Intrauterine treatments by antibiotics, chemotherapeutics or antiseptics are still used more or less routinely. The effect of these treatments is however poorly documented. Many therapeutic trials have no negative controls and/or include small numbers of animals making the interpretation difficult. The absorption of many drugs is greatly diminished in the postpartum uterus. It should also be noted that many of these drugs have a negative effect on phagocytosis some of these compounds are irritating and cause enhanced risk for endotoxin absorption. To support the uterus own self curative process by offering the cow a clean environment and a careful care is a good alternative to medical treatment and will lead to recovery in most cases.

Non-steroid anti-inflammatory drugs (NSAID) suppress inflammation and inhibit prostaglandin synthesis. In a recent experiment we tested to give flunixin to RFM cows in different combinations with and without antibiotics⁵. In conclusion, we failed to see any positive effect of flunixin on the recovery. However our opinion is that flunixin treatment to RFM cases is worth further evaluation as a welfare increasing treatment supporting the spontaneous recovery.

Metritis is an inflammatory process of all layers of the uterine wall and typically occurs within two days after parturition. There is a foul smelling vaginal discharge and the cow is systemically ill often with signs of septicaemia. The condition is life threatening and need prompt systematic antibiotic and fluid therapy. The addition of NSAID may in these cases support the recovery.

In most animals however the uterine cleansing process will progress during the consecutive three weeks p.p. clinically seen as lochia. It is important not to interfere in this process and the routines in Sweden is not to treat any systemically healthy cows based on discharge before 4 weeks p.p. This has led to a decreased incidence of treatment for endometritis to below 1% without any obvious negative effects on fertility. Our routines were recently supported by Le Blanc et al⁶ finding no benefit of treatment of endometritis before 4 weeks postpartum in a study containing 1865 cows in 27 herds in Canada.

Résumé

Chez la vache laitière, la période autour du vêlage et le post partum précoce sont des périodes particulièrement critiques pour la suite des événements de reproduction. Des problèmes rencontrés pendant cette période peuvent avoir un impact très négatif sur la fertilité et la santé futures de l'animal et par conséquent peuvent être la source de pertes économiques pour l'éleveur. Dans cette présentation, les commémoratifs, le diagnostic, le traitement et la prévention de la mortalité pré et périnatale, du prolapsus utérin, des rétentions placentaires et des métrites seront brièvement décrits".

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